Spray dried periodic mesoporous silicas and PMOs applied in chromatography, a comparison.

Ide, Matthias*(1); Lynen, Frédéric(2); Sandra, Pat(2); Van Der Voort, Pascal(1)

(1) Department of Inorganic and Physical Chemistry, Centre for Ordered Materials, Organometallics and Catalysis (COMOC), Ghent University.

(2) Department of Organic Chemistry, Laboratory of Separation Sciences, Ghent University.

Krijgslaan 281 (S3(1) & S4bis(2)) B-9000 Ghent, Belgium.

Introduction:

Since 1992, thousands of papers have appeared on the (hydrothermal) synthesis of mesoporous ordered silicas. The number of papers on spray drying of these materials is fairly low and papers on spray dried PMO materials are even scarcer. This contribution deals with spray dried ordered mesoporous (organo)silica materials applied for high performance liquid chromatography (HPLC).

Experimental:

Micrometer sized spherical mesoporous silica [1] and PMO particles were synthesized to use as a packing material for High Performance Liquid Chromatography. Spray drying was used to create perfect spheres with an easy scale up. The entire synthetic procedure was optimized to ensure optimum particle morphology while preserving a high surface area and acceptable yields. The resulting particles posses a hexagonal MCM-type pore system. To replace as much silicon-oxygen bridges as possible the $(EtO)_2Si(CH_2)]_3$ precursor was used. This precursor yields ring-PMOs.[2] The materials were subsequently treated with a C-18 silane in a grafting procedure for reversed phase LC application and packed into columns.

Results and Discussion:

A doubling in retention time was observed compared to conventional commercial HPLC columns of the same dimensions. This could be related to a much-increased accessible surface in the pores when compared to conventional HPLC materials with random pore sizes.[4]

Apart from their large surface area, PMO materials possess an organic group between two silicon atoms. This leads, particularly in the case of ring PMOs, to increased hydrolytical stability[2] and an extended lifetime expectancy of the columns. This way a PMO column lasts much longer when used under the same conditions as a commercial column. Secondly water with higher temperatures could be used, leading to a reduction of solvent usage, which is more economical and more environmentally friendly.

[1] Ide, M.; Wallaert, E.; Van Driessche, I.; Lynen, F.; Sandra, P.; Van Der Voort, P.; *Microporous and mesoporous materials* **2010**, DOI: 10.1016/j.micromeso.2010.12.013.

[2] Goethals, F.; Meeus, B.; Verberckmoes, A.; Van Der Voort, P.; Van Driessche, I.; *Journal of Materials Chemistry* **2010** *20*, 1709.